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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|---------------------|------------------|
| 10/814,627 | 04/01/2004 | Kan Yasui | XA-10076 | 7588 |
| 181 | 7590 | 07/27/2005 | EXAMINER | |
| MILES & STOCKBRIDGE PC 1751 PINNACLE DRIVE SUITE 500 MCLEAN, VA 22102-3833 | | | THOMAS, TONIAE M | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2822 | |

DATE MAILED: 07/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|--------------------------------------|-------------------------------------|--|
| Office Action Summary | Application No. 10/814,627 | Applicant(s) YASUI ET AL. | |
| | Examiner Toniae M. Thomas | Art Unit 2822 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 April 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 07/22/04.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Ahn et al. (US 2002/0168873 A1).

The Ahn et al. pre-grant published application (Ahn) discloses a semiconductor device manufacturing method (figs. 5-7 and accompanying text). The method comprises the steps of: forming a trench by etching a silicon substrate 10 (fig. 5 and par. 39, lines 1-2); forming a silicon nitride film 47 along an inner wall of the trench (fig. 5 and par. 39, lines 3-6); and converting a part of the silicon nitride film to a non-silicon-nitride type insulator film (par. 39, lines 12-15).¹

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary

¹ The surface of the silicon nitride film is the part of the silicon nitride film which is converted.

skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 2-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ahn et al. in view of Ahn (US 2002/0072198 A1).

Ahn discloses a method for forming a semiconductor device, wherein the method comprises the steps of: forming a trench by etching a silicon substrate (fig. 5 and par. 39, lines 1-2); forming a silicon nitride film 47 along an inner wall of the trench (fig. 5 and par. 39, lines 3-6); converting a part of the silicon nitride film into a non-silicon-nitride type insulator film (par. 39, lines 12-15); and forming a second embedded insulator film 51 inside the trench and filling the trench with the second embedded insulator films (fig. 5 and par. 39, lines 16-24).

Prior to forming the silicon nitride film along the inner wall of the trench, the inner wall of the trench is oxidized to form a silicon oxide film 45 (fig. 5 and par. 39, lines 2-3).

A lower portion of the non-silicon nitride insulator film is positioned lower than a channel depth of a subsequently formed MOS transistor.

The second embedded insulator film is a polysilazane-type SOG film, which is formed by a coating method (par. 39, lines 16-24).

While Ahn teaches forming a second embedded insulator film and filling the trench with the second embedded trench, Ahn does not teach forming a first embedded insulator film inside the trench. However, Ahn '198 discloses a method for forming a semiconductor device, wherein the method comprises

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forming a first embedded insulator film 129 inside a trench, and forming a second embedded insulator film 139 on the first embedded insulator film (fig. 10, par. 32, and pars. 37-38). In a preferred embodiment, the first embedded trench is formed by an HDP-CVD method (par. 32, lines 7-12).

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to form a first embedded insulator film, as taught by Ahn '198, because trench gap filling performance can be improved (Ahn '198 - par. 40, lines 6-9).

The prior art of record does not teach converting the silicon nitride and forming the second embedded insulator film using an in situ process.

However, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, since insitu processing reduces the risk of exposure to contaminants outside the processing chamber.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Toniae M. Thomas whose telephone number is (571) 272-1846. The examiner can normally be reached on Monday through Friday from 8:30 a.m. to 5:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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TMT
25 July 2005

A handwritten signature in black ink, appearing to read 'Mary Wilczewski', with a stylized flourish at the end.

Mary Wilczewski
Primary Examiner